# AGRICULTURAL Research

June 1962 / U.S. Department of Agriculture



## Honor Awards

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AGRICULTURAL
# Research

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## A Bargain

What has agricultural research done for the United States—for us? One thing is obvious. Research has shown farmers how to produce abundantly so that we have a large variety of wholesome and nutritious foods all year.

Other benefits are less obvious. For example, if farmers today used 1940 methods, it would cost an extra $13 billion a year to produce food and fiber for the Nation. This extra cost would be passed on to consumers, adding more than $5 a week to each family's bill for farm products.

Most people in the world spend half their available income on food. And in undeveloped areas, people spend most of their time grubbing a living from the earth.

Because U.S. agriculture is efficient, however, most of us spend only about a fifth of our income on food and none of our time producing it.

The $13-billion-a-year saving has more meaning when compared to the cost of research. The bill for all agricultural research in the last 100 years—paid by State and Federal governments and by industry—is less than $6 billion.

Research truly has been a bargain. And in the years ahead it will prove to be an even bigger bargain.

Our population is expected to double in the next 40 to 50 years. Research can help agriculture by developing new ways to better supply products for all these people, and quite likely for many others in the world.

But scientific manpower threatens to be scarce in years to come. Most agricultural scientists come from farm families, and the rural population is constantly decreasing. Consequently, one of the best sources of scientists is decreasing—and enrollments in agricultural colleges aren't increasing generally.

This potential shortage of scientists has been recognized by ARS which, through formal efforts and informally, is encouraging young people to study agriculture and related sciences in high school and college . . . through graduate school.

These students, who now are preparing for a career in research, will be the agents of future scientific advances—the bargains of the years to come.

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Growth Through Agricultural Progress

**AGRICULTURAL RESEARCH SERVICE**
**United States Department of Agriculture**

# "...for Distinguished and Superior Service"

**Each year outstanding achievements of USDA employees are recognized by the presentation of distinguished and superior service awards. On May 18, Secretary Orville L. Freeman so honored 21 individuals and 3 work units of ARS**


**Distinguished Service Awards:**

J. W. MITCHELL, *Crops*, for leadership in conducting and stimulating research on plant growth regulators and antibiotics, including basic research on their movement in plants, and development of uses for these materials.

W. L. POPHAM, *Deputy Administrator*, for leadership in regulatory and control programs relating to insect pests and plant and animal diseases.

**Superior Service Awards:**

S. R. OLSEN, *Soil and Water*, for pioneering research on the chemistry of phosphates in western calcareous soils and development of principles governing soil-water-plant relationships.

R. J. DIMLER, *Northern Utilization*, for scientific contributions on the constituents of cereal grains that made possible the development of dextran as a replacement for blood plasma.

O. A. VOGEL, *Crops*, for developing semidwarf wheat for the Pacific Northwest and machines that facilitate small-grain breeding.

A. M. LUCAS, *Animal Husbandry*, for leadership and accomplishment in research resulting in the publication of the first reference guide on avian histology for poultry scientists and inspectors.

J. W. WHITE, JR., *Eastern Utilization*, for planning, supervising, and evaluating research on honey, developing improved research methods, and disseminating research results.

N. G. SANTACROCE, *Plant Quarantine*, for exceptional administration of plant quarantine preshipment inspection in Europe.

W. C. SHAW, *Crops*, for leadership in research on control of weeds in farm crops, for development of techniques for evaluating potential herbicides, and for stimulating weed-control research.

W. L. STANLEY and R. M. IKEDA, *Western Utilization*, for work on the chemistry of essential oils in citrus, leading to synthesis of useful compounds, stabilization of valuable flavoring agents, and identification of authentic products on the market.

R. O. HUGHES, *Crops*, for preparing interpretive and accurate original detailed drawings of plants of many species, for abstracting scientific papers, and translating foreign publications.

E. B. LAMBERT, *Crops*, for accomplishment and leadership in research on mushroom physiology, nutrition, diseases, and culture.

*Turn Page*

## HONOR AWARDS

(*Continued*)

W. Binns, *Animal Diseases and Parasites*, for work concerned with poisonous plants, initiating ways to study causes of fetus abnormalities, and methods to treat and prevent livestock poisoning.

E. F. Phipard, *Consumer and Food Economics*, for evaluating research findings in food and nutrition, and translating them into guidelines for programs of food distribution and education.

J. C. Brown, *Soil and Water*, for contributions to basic knowledge of plant nutrition, and control of iron chlorosis (yellowing of plants) with chelates (compounds that form complexes with iron).

J. R. Scott, *Meat Inspection*, for exceptional initiative, competence, and knowledge in administering a national label-control program that protects consumers by assuring true and informative labels and markings on meat products (posthumous).

C. W. Sabrosky, *Entomology*, for outstanding contributions to, and leadership in, the development of stability and international uniformity of scientific names for many kinds of animals.

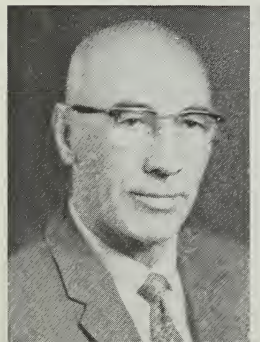
G. E. Vanden Berg and I. F. Reed, *Agricultural Engineering*, for developing instruments that compute research findings from tests of tire and traction devices at the time tests are conducted, thereby greatly increasing research productivity and accuracy.

F. A. Coffman, *Crops*, for improving winter oats and initiating uniform testing nurseries that have brought national and international recognition to the oat-improvement research program of USDA.

*Cotton Carding Investigations Group, Southern Utilization*, R. S. Brown, A. L. Miller, and R. A. Rusca for the development of a radically new method for carding cotton, which contributes to the production of textiles of improved uniformity at lower cost.

*Feed and Forage Antioxidant Group, Western Utilization*, E. M. Bickoff, M. J. Copley, F. De Eds, J. Guggolz, G. O. Kohler, H. F. Launer, A. L. Livingston, F. A. Loewus, W. D. Maclay, H. S. Olcott, J. O. Thomas, C. R. Thompson, G. R. Van Atta, I. Van Ford, E. D. Walter, and R. H. Wilson for developing ethoxyquin, stabilizer for preserving nutrient values of dehydrated forages and mixed feeds.

*Knoxville Fiber and Spinning Laboratory, Crops*, R. G. Connor, P. R. Ewald, K. L. Hertel, H. Hutchens, R. S. Krowicki, C. B. Landstreet, R. Lawson, E. N. Norman, C. M. Waggoner, G. B. Western, and S. Worley, Jr., for contributions to cotton genetics and breeding research by developing equipment and techniques for determining fiber properties and spinning value from miniature samples of fiber.☆



*J. W. Mitchell (right) cited for research on plant growth chemicals; W. L. Popham for efforts in pest and disease control.*

*Modern research methods have been used judiciously in developing the large number of improved crops available to farmers*

■ Advances in crop science have been enormous, considering all the new and improved varieties available. For example, soybeans owe nearly everything to science.

Only a minor crop in the United States a little more than 50 years ago, soybeans are now our fifth most important cash crop and our most important source of vegetable oil.

Modern agricultural research, which got underway in the United States with establishment of USDA 100 years ago, made today's soybean crop possible.

At about the turn of the century, farm scientists began seriously to apply through plant breeding the knowledge that the gene is the entity in the germ cell of all living things by which characteristics are passed from generation to generation. Soybeans were among the important beneficiaries of this systematic approach to genetics.

The result in the case of soybeans has been several new varieties, all with special qualities—adaptability to cold and heat, to drought, improved pro-

Sixth in a Centennial Series

# CROPS

*Soybeans in Indiana: Crop is now main source of vegetable oil in U.S.*

ductivity, and many of the qualities wanted by consumers and processors.

The man who had the most influence in making modern crop improvement possible was an Austrian monk named Gregor Johann Mendel. His contribution was simple and revolutionary: In raising garden peas (which he crossed experimentally) he carefully sorted the progeny of parent plants according to characteristics. He learned that plant characteristics were handed on by the parents in definite mathematical ratios. For the first time, definite laws of inheritance were established.

Mendel died in 1884, and it took the world about 15 years to realize what he had accomplished. His work was republished in 1900.

Our improved soybeans are only one example of better crops.

Hybrid corn is another. It is resistant to disease and weather, and hybrid corn seed is used in nearly all plantings in the United States today.

### Breeders made good use of hybrid vigor

The principle of hybrid vigor has been used widely in scientific breeding of other crops. All of these improved varieties—and new ones are continually being added to overcome new challenges and environmental problems—have helped to make us the best fed people in the world.

Times are still changing, though, even after 100 years of intensive crop science.

Scientists believe that the success with soybeans and corn may already be outdated. These scientists are convinced that they are about to uncover important new knowledge about genes and living cells.

They say that the gene may not be the fundamental unit of heredity, after all—that the true secret of heredity is locked up in chemical subunits of the gene. Understanding the organization of these genetic subunits and of all living cells is what they seek today.

An impressive start has already been made in understanding the function of living cells. Just 2 years ago, for example, ARS scientists discovered that plant growth responses are governed by a reversible chemical reaction involving two forms of a light-sensitive pigment.

Adding to this information, bit by bit, the scientists envision a time when it will be possible to control plants closely through the whole course of their development.☆

*Self-pollination of corn is controlled by bagging in studies aimed at improving plant through research on genetic variability.*

*In the Southeast*

# BENEFITS FROM CARRYOVER NITROGEN

■ Nitrogen fertilizer not used by the first crop after heavy application isn't all lost by leaching in the Southeast. Instead, carryover nitrogen may significantly benefit a second or even third crop, USDA research shows.

Available nitrogen in the soil—unused by the previous crop—has been given little consideration in making fertilizer recommendations. However, accuracy of fertilizer-need estimates could be improved by taking this residual nitrogen into account.

Such nitrogen could also be used by a winter cover crop seeded after the fertilized crop is harvested.

ARS soil scientists point out that a significant amount of nitrogen remains after the first crop *only* when application rates are high.

Studies of residual effects of nitrogen fertilization were made by these scientists, in cooperation with the Alabama, Georgia, and Mississippi Agricultural Experiment Stations. The researchers conducted experiments on widely different soils at seven locations.

On some plots, nitrogen fertilizer was applied in late fall, and corn was planted the next spring. Other plots were fertilized in the spring just before the corn was planted. After corn harvest, all plots were seeded to wheat or oats as a winter cover crop, which was followed by a second corn crop in the spring. No additional nitrogen was applied on either the winter cover crop or the second corn crop.

Carryover effects of spring- and fall-applied nitrogen were measured on the winter cover crop and the second corn crop. Yields of fertilized plots and unfertilized check plots were compared.

### Best performance from spring treatments

Spring-applied ammonium nitrate, 200 pounds per acre, increased average small grain dry forage yields 1,600 pounds and second crop corn yields 19 bushels per acre.

Fall-applied nitrogen increased small grain dry forage yields only 490 pounds per acre. The carryover effect of fall-spread nitrogen fertilizer on the second planting of corn 1½ years later was negligible.

Fall applications also gave lower yields than spring applications on the corn crop to which the nitrogen was applied. The scientists calculated—on the basis of results from all tests—that fall application is only 49 percent as effective as in spring in increasing yields of corn.

Response to fall fertilization varied considerably between years, and was consistently greater in some locations than others.

These variations cannot be explained by differences in surface-soil texture or subsoil permeability, researchers say. Nor are the variations directly related to total amount of winter rainfall, runoff water, or water percolation into soil.

The scientists do suggest, however, that greatest loses of nitrogen from percolation in winter may occur during mild weather that permits microbial activity.

In addition to ammonium nitrate, plots were fertilized with either anhydrous ammonia, urea, sodium nitrate, or ammonium sulfate. No nitrogen source was consistently superior or inferior to others in the tests.☆

# LOW-COST SUBSURFACE DRAINAGE

■ Two recent developments—a new type of plastic liner for mole drains and improved equipment for installing it—may make low-cost subsurface drainage usable by agriculture and the construction industry.

Both developments are results of 7-year USDA-State-industry research on new materials for stabilizing mole-drain channels. Except in some muck soils, unlined mole drains generally have not been successful in this country.

The channels are formed by drawing a blade or bullet-nosed cylinder, 6 inches in diameter, through soil 25 to 30 inches below ground surface.

The new plastic material is fastened with interlocking tabs after it is formed in tubular shape in the drain channel. An earlier liner was overlapped but not fastened (AGR. RES., Jan. 1960, p. 7). In Ohio experiments, the interlocking liner held its cross-sectional size and shape much better than the overlap type.

ARS agricultural engineer J. L. Fouss found that the interlocking liner was still 3 inches in diameter 9 months after it was installed in a slowly permeable silty clay-loam soil. Diameter of the overlap-type liner had been reduced from 3 to 2 inches or less.

Though these results are encouraging, Fouss says 4 to 6 years of field testing will be needed to fully evaluate the

new plastic liner. Installations of the interlocking-type liner have been made in cooperation with agricultural experiment stations in Ohio, Minnesota, North Dakota, and Indiana.

The interlocking liner is formed from a 10-inch-wide sheet of 15-mil polyvinylchloride plastic. Interlocking tabs are prestamped along edges of the sheet.

A special mole-plow attachment is used to install the liner (AGR. RES., Jan. 1959, p. 10). The plastic material is unwound from a 600-foot roll, folded into a tight U, and pulled down a vertical chute to the tubular base of the implement. There the plastic is pulled around a 45° directional-change roller, so it is parallel with the drain channel, and the interlocking tabs are fastened. The plastic liner emerges in tubular shape as the machine moves forward.

Modification of the equipment has ended difficulties encountered earlier. For example, infrared lamps heat the supply roll to prevent brittleness of the semirigid plastic during cold-weather installation.

### Grade of drain is controlled automatically by device

Engineers have devised an automatic device to control the grade of the drain, regardless of fluctuations in ground surface. Field testing is underway.

A pendulum on the plow beam senses changes in slope of the beam as the machine moves forward. The pendulum activates electrical switches that control hydraulic solenoid valves for raising or lowering the front of the beam. The system maintained an 0.2-percent gradient when the plow was moving 80 to 125 feet a minute.

Effectiveness of plastic-lined drains has been improved by a device on the installing machine. This device closes the opening immediately above the liner and initiates bridging of soil over the liner.

Bridging tends to transfer forces caused by surface loads to the soil on the sides of the mole channel. When bridging occurs, considerable depression of the ground by surface loads is needed before lined or unlined mole channels collapse. The principal function of the liner is to keep soil from falling from the roof of the channel, not to resist surface loads.

If this method of subsurface drainage proves successful, its most important application will be for water table control in firm-textured soils, within the depth range of installation equipment.

The drains may be used for subsurface distribution of irrigation water in the West, as interceptor drains on hillside seeps, and for drainage of airports, golf courses, parks, storage areas, and building sites.☆

# *Double Duty for Chlordane*

■ The insecticide chlordane may help plant pathologists in keeping greenhouse plants free of powdery mildew fungus—especially when the scientists want to study other fungus diseases.

The possibility of using chlordane for powdery mildew control occurred to an ARS scientist when he found it difficult to establish experimental mildew infections in a room where chlordane was used on insects. The scientist, plant pathologist A. L. Scharen, was using wheat plants in studies at Beltsville, Md.

In subsequent tests, Scharen showed that chlordane protects plants from mildew without retarding infection by black stem rust, speckled leaf blotch, or glume blotch of wheat. He was able to study these fungus diseases without having specimens contaminated by mildew.

A suspension of 3 grams of active chlordane per liter of water sprayed on wheat seedlings prevented powdery mildew infection for 10 days. Less than 5 percent of the leaf surface was covered by the fungus 25 days after treatment.

In three experiments, Scharen applied suspensions containing 0.5, 1, 2, 3, and 4 grams of chlordane per liter of water, spraying until liquid began to drip from the leaves. Conidia (spores) of the fungus (*Erysiphe graminis*) were dusted onto the seedlings 24 hours after the chlordane treatment. Seedlings of seven susceptible spring, winter, and durum wheats were used.

Many shriveled and dead conidia were found on chlordane-treated leaves examined under a microscope. Vegetative portions of the fungus were granulated and distorted.

There was slight reduction of infection after plants were dusted with spores, then sprayed with chlordane. Spread of the fungus was decreased by drenching potting soil with chlordane and by treating benches holding potted seedlings.

Neither method was as effective as treatment of seedlings.☆

Making better use of moisture from snow on Great Plains farms depends on improving . . .

# FIELD SHELTERBELT DESIGN

■ Field shelterbelt design may become important in helping Great Plains farmers make better use of moisture from snow.

An opportunity to improve the design of field shelterbelts is seen as a result of finding that comparatively open, single-row windbreaks distribute snow more evenly on cropland than dense, multiple-row barriers. Even distribution of snow builds up soil moisture reserves over an entire field; drifts concentrate the moisture in limited areas.

But much more research is needed to determine the best type of shelterbelt for conserving moisture and providing good protection against wind-caused erosion.

Information developed so far indicates that open barriers will give best results on cropland only if proper tillage practices are used. Conventional, multiple-row shelterbelts are still recommended for protecting farm buildings and feedlots.

ARS silviculturist E. J. George tested various types of shelterbelts for several winters in North Dakota. He was assisted by agronomist Don Broberg and woodland conservationist E. L. Worthington of USDA's Soil Conservation Service.

They learned that snow drifts rather gradually away from the lee side of an open shelterbelt. In contrast, it piles up high close to the lee side of a dense barrier.

### Barrier density controls wind patterns

This difference is caused by contrasting wind patterns on the lee side. The wind patterns, in turn, are controlled by barrier density. Wind velocity decreases sharply on the lee side of a dense barrier and resumes open-field velocity quickly. In passing over an open barrier, however, wind does not lose so much speed and tends to resume open-field velocity more slowly.

George developed a method of calculating barrier density, because it is a key factor in snow distribution. He determines the percentage of space—in a photo of a barrier—occupied by the solid parts of the barrier.

In the tests, a single row of cottonwoods about 70 feet high controlled snow distribution best. Density of this shelterbelt was 37 percent in the crown area and 10 percent along the trunks, the lowest among shelterbelts studied.

On the lee side of the cottonwoods, snow spread out at a uniform depth of 6 inches for a considerable distance. Wind velocities dropped only slightly on the lee side, averaging 81 percent of open-field speed 5 tree heights (5H) away and 83 percent 20H away.

In contrast, deep drifts formed immediately behind a row of thickly branched Siberian pea hedge, 14 feet high and with a density of 58 percent. Wind velocities on the lee side of this shelterbelt averaged 42 percent of open-field velocity at 5H, but were 89 percent of open-field velocity at a distance of 20H.☆

*Dense shelterbelts (two examples at left) cause snow to pile up on windward side and can delay seeding of crops.*

*Poor and good snow distribution are contrasted. The low-density windbreak (right) resulted in good distribution.*

*Another low-density windbreak: Snow in back of this one was distributed over a band 400 feet wide.*

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*Annual Jap beetle bill: $10 million. Beetle eats flowers, fruits, leaves; grub eats plant roots.*

# KEEPING JAP BEETLES OFF PLANES

*A completely safe dry DDT aerosol will be used in making treatments before passengers go aboard*

■ An improved procedure for reducing risk of Japanese beetles being spread by airplane is ready for use this summer. It helps to protect a vast portion of the United States, and other countries, from beetle invasion.

When the destructive plant pests appear in large numbers during their flight season—mid-May to mid-August—at commercial and military airports in the East, the insects are likely to enter aircraft.

Interiors of planes leaving or stopping at such ports will be treated with a dry DDT aerosol before passengers board. Without this completely safe treatment, planes might carry the pests to noninfested parts of the United States and to other countries. The beetle is now found in parts of 15 eastern seaboard and adjacent States, with spot infestations as far west as eastern Missouri. Eradication of an outbreak found last year at Sacramento, Calif., is underway.

A Federal quarantine to prevent spread of the beetle requires the new aircraft treatment when an airport is declared excessively infested.

*Airline employee and ARS inspector, supervising, wear respirators commonly used in applying insecticides in confined spaces. A treated plane is safe, odorless, dust free for passengers.*

*Aerosol leaves no visible dust, but plane surfaces are wiped before passengers board.*

*ARS inspector collects dead Jap beetles from the floor of plane that was aerosol-treated.*

The dry aerosol is more effective than the liquid aerosol spray previously used. It kills beetles for 24 hours after application. Carbon dioxide in an ordinary fire extinguisher blows a very small amount of the dust, 85 percent micronized DDT, from a plastic tube into plane cabins and baggage and cargo compartments. A very minute quantity of DDT, about one-fifteenth of an ounce, will treat 1,000 cubic feet of space. Practically no dust remains visible on the plane's interior surfaces.

ARS scientists devised the procedure in their continuing search for improved ways of controlling pests. They adapted applicator and method from those developed several years ago to treat refrigerated railway cars.

ARS plant pest control workers train airline employees and personnel at military airports in application techniques, and see that treatment is adequate.

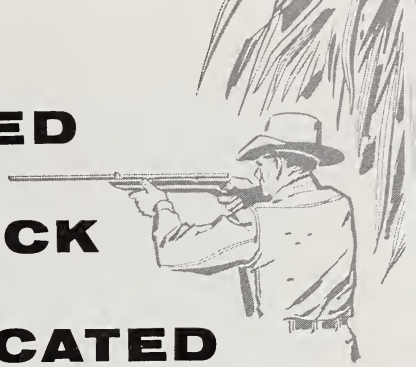
### Dust and equipment from ARS this year

Since the micronized dust is not commercially available and application equipment is still being developed, ARS is furnishing material and equipment for 1962 treatments.

In recent years, beetles have been found and destroyed on U.S. military planes landing in England, Scotland, Germany, France, and Italy.

The Japanese beetle attacks more than 200 agricultural and ornamental plants, causing damage of about $10 million annually.☆

# RED TICK ERADICATED



■ The red tick, *Rhipicephalus evertsi,* potential carrier of several animal diseases including cattle tick fever and east coast fever, has been eradicated from the United States.

In the fall of 1960, three infestations of the African parasite were discovered. Infestations on zebras at Tampa, Fla., and Hudson, N.Y., were eradicated in 1961. Recently the last infestation was eradicated from a 135-acre wild-animal compound near Boca Raton, Fla.

USDA veterinarians, who cooperated with officials of the two States to eradicate the tick, say that had the infestations spread to our native wild and domestic animals, eradication would have been extremely difficult, if not impossible.

This tick's life cycle would make control difficult. Unlike the cattle fever tick that is a one-host parasite, the red tick is a two-host parasite. Larvae and nymphs attach themselves deep down in the inner ear surface of wild and domestic animals, where the pests are difficult to detect and impossible to treat with ordinary dips or sprays. The engorged nymphs drop to the ground, molt, and as adults attach to a new host, usually in the area between the hind legs.

Eradication of the Boca Raton infestation required spraying the compound and surrounding area with DDT every 3 weeks for 30 weeks. (This is the first time that area treatment has been successfully used in eradicating a tick.) Two pounds of insecticide per acre were used for each treatment. Area treatment proved effective, because the female tick spends a large part of her life cycle on the ground.

Inspecting the wild animals for ticks to determine effectiveness of the sprays proved the most difficult part of eradication. Living under almost natural conditions at Boca Raton were 22 Abyssinian asses, 6 aoudads, 33 camels, 21 eland, 2 elephants, 27 gazelles, 12 giraffes, 4 gnus, 26 nilghai, 98 zebras, and 72 ostriches. Most of the individual wild animals had to be shot with a temporary paralyzing agent—loaded hypodermic darts—for safe handling.

In addition, the Florida-USDA eradication team inspected domestic animals maintained near the compound and some 1,300 native wild animals trapped in the area. Red ticks were not found on the domestic or wild animals, which included opossum, raccoon, rabbit, skunk, rat, bobcat, fox, squirrel, and birds.

The Tampa and Hudson infestations were traced to a 1960 shipment of zebras from Africa. These ticks were eradicated by insecticide treatment of the zebras, other animals housed near them, premises, and surrounding areas. Origin of the other infestation is unknown.☆

**Some forms of milk can be used interchangeably in recipes, but cooks may have to adjust recipes if they want to use other forms to best advantage**

# A Guide for Cooking With Milk

■ The many different forms of milk on the market today, fresh and processed, have made this important food more convenient to use. They also have brought new problems to cooks.

The most frequent question that comes to USDA from food service establishments and homemakers is: Can the various forms of milk be used interchangeably in recipes?

Some milk products can be alternated successfully. For others, adjustments in recipes are needed.

To obtain basic information to guide in using milk to best advantage, ARS food quality specialists tried out the various forms in making white sauce and baking powder biscuits and compared results.

White sauce is typical of much of the milk cooking that is done on top of the stove. Results thus are a guide to using different forms of milk in cream soups, creamed meats or vegetables, most milk sauces and gravies, cornstarch puddings, and cream pie fillings.

### Five forms of milk were used in sauce

The basic recipe for white sauce was tested, using 15 lots of milk—fresh whole homogenized, fresh skim, 6 brands of dry whole, 4 brands of nonfat dry, and 3 brands of evaporated. (Evaporated milk was diluted with an equal measure of water. Dry milk was reconstituted with water.)

Different forms of milk can make considerable difference in thickness of white sauce, the researchers learned. Evaporated milk, though diluted, made a much thicker sauce than any other milk. Fresh skim milk and nonfat dry milk made the thinnest sauce. Whole milk, fresh and dry, made sauce that thickened considerably as it cooled, because the fat it contained congealed in cooling.

Different brands of dry whole milk varied much in weight per cup. So for accurate cooking results, the researchers recommend weighing it, rather than the usual measuring.

Biscuits were chosen as typical of quick breads in which milk is used in making dough. The baking powder biscuit recipe was tried with 12 lots of milk—fresh whole homogenized, fresh skim, fresh buttermilk, and 2 brands each of dry whole, dry skim, and evaporated milk.

Some of these forms of milk moistened the flour much more readily than others. The quantity of milk and mixing of the dough needed to be adjusted to make tender biscuits. The thinner forms of milk had greater moistening ability than the thicker forms. For the desired tenderness in biscuits, the study showed that smaller measures of fresh whole, fresh skim, and nonfat dry milk are needed than of fresh buttermilk, evaporated, or dry whole milk.

Biscuits made with fresh whole, fresh skim, nonfat dry, and evaporated milk were most tender and palatable after 14 seconds of mixing before baking. Those made with buttermilk and dry whole milk were best after 20 seconds of mixing. An electric mixer was used.☆

*Objectionable but harmless feed flavors can be removed in one operation instead of two*

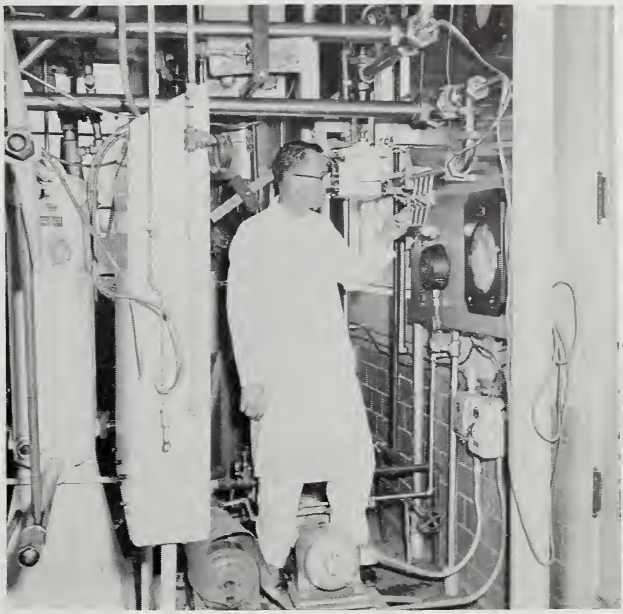
# Cost-Cutting Way to Deodorize Milk

■ A more economical way of removing off-flavors from milk—without exceeding the required pasteurization temperature—has been devised by USDA scientists.

The new method brings milk to pasteurization temperature (161° to 165° F.) by steam injection, and then deodorizes it by flash cooling in a vacuum chamber. Volatile flavors with which the milk may be contaminated are removed in the vacuum chamber, along with water that was added as steam.

In conventional deodorization, milk is pasteurized by a heater, then steam injected to raise its temperature, usually up to 195° F. or higher. After this, the off-flavors and added water are removed by vacuum treatment.

At different times of the year and in different parts of the country, milk has to be deodorized to remove flavors from such sources as wild onions, pasture grasses, and feed. Most milk can be improved generally by deodorization, and many dairies use the process routinely to keep milk flavor consistent.



*Dairy technologist H. E. Walter operates the pasteurizer-deodorizer installed in Eastern utilization laboratory, Beltsville, Md.*

### Lower cost may encourage wider use of deodorization

A still wider use of deodorization may be encouraged by the lower operational cost of this new method. It combines in one step the conventional two-step process of pasteurization and deodorization, and it operates at lower temperatures.

A complete pilot plant for processing milk by this method was installed in the Dairy Products Laboratory of the Eastern utilization division, Beltsville, Md. Some essential features of the pilot setup have been incorporated in the plant of a large southern dairy, where 65,000 pounds (31,000 quarts) of milk are processed an hour.

The improved process was developed by ARS mechanical engineer F. P. Hanrahan and dairy technologists H. E. Walter, A. M. Sadler, and R. P. Tittsler. They adapted a steam-injection heater developed by Western utilization division scientists for pasteurizing, deodorizing, and concentrating liquid foods.

In processing milk for cheese, steam injection is not used. Instead, the milk is pasteurized in a conventional heat exchanger, from which it goes to the vacuum chamber for deodorization. Since there is no added water to remove, the vacuum treatment also concentrates the milk by about 8 percent. From the vacuum chamber, the milk goes directly to cheese vats at the final processing temperature.

By using this slightly concentrated milk, cheesemakers can increase the capacity of their plants without installing additional vats. The process also reduces the volume of whey left over to be dried, concentrated, or otherwise disposed of.

Cheddar cheese made by this more economical process is as good in flavor, body, and texture as cheese made with conventionally processed milk.☆

# Mildew Resistance in Highbush Blueberries?

■ Tests are providing information that may help scientists develop resistance to powdery mildew in future varieties of highbush blueberries. Highbush varieties furnish most of the fresh blueberries for market.

Powdery mildew robs plants of vitality needed to develop high-quality fruit and to withstand attacks of subsequent, more serious, diseases. Mildew causes premature defoliation, which weakens the plants.

Chemicals can be used to control the disease, but usually aren't. Symptoms don't appear until after harvest, the effect on yields is difficult to evaluate, and the cost of control may outweigh any benefits.

Since growers may accept losses caused by the disease rather than control it, scientists hope to eliminate mildew susceptibility by breeding and selection.

More than 650 seedlings of 17 varieties grown in the East were tested for resistance to powdery mildew. ARS horticulturists J. N. Moore and D. H. Scott cooperated with research horticulturist H. H. Bowen of the New Jersey Agricultural Experiment Station.

In evaluating these seedlings and the parent varieties, the scientists scored relative susceptibility of the plants on a scale of 0 to 4. No infection was indicated by 0, and a very severe infection by 4. Plants receiving a score of less than 1 were considered very resistant, 1 to 2 moderately resistant, and more than 2 no desired resistance.

The varieties Berkeley, Earliblue, and Ivanhoe were very resistant to powdery mildew. Their scores were 0.5, 1, and 1, respectively.

Blue crop and Rancocas scored 1.5, and Weymouth, Pemberton, Coville, and Dixi scored 2. Collins, Stanley, Rubel, Blueray, Burlington, Herbert, Jersey, and Atlantic all lacked desired resistance.

In general, the same varietal resistance was found in young and mature plants, although mature plants were slightly more resistant.

Almost every progeny produced plants in each disease class, the scientists found in evaluating the crosses.

Most offspring whose parents were resistant produced a high proportion of resistant plants. Most of those with parents of low resistance produced progeny with low resistance.

Genetically, resistance appears to be partly a dominant characteristic. Preliminary research indicates young seedlings can be screened in the greenhouse and many of the ones with low resistance eliminated.☆

# Muscadine Grapes for the Southeast

■ Five new muscadine grapes, adapted to the Southeast, have been developed by ARS and the North Carolina Agricultural Experiment Station.

All are superior producers and self-fertile. Most varieties of muscadines are self-sterile and unfruitful when planted alone. The new varieties can be used alone in home gardens or commercially to pollinate self-sterile varieties of the same fruit color.

A limited supply of rooted cuttings of each variety is available at the North Carolina Agricultural Experiment Station, Raleigh. These plants are being released to nurserymen by North Carolina Foundation Seed Producers, Inc., for increase. Nurserymen will have plants for sale in 1963. USDA has none for distribution.

*Albemarle* has large, smooth, blue-black fruit of good flavor that ripens in midseason. It is superior to Burgaw, Duplin, and Tarheel in fruit size, sugar content, and flavor and equal to these varieties in production, vine vigor, and disease resistance. Albemarle is resistant to leaf diseases.

*Pamlico* has large light-green fruit that ripens in midseason. It is superior to Willard and Wallace in flavor and size, vine vigor, and disease resistance and to Dearing in fruit size, appearance, and flavor.

*Chowan* has light-brown to bronze fruit with a pleasing subacid flavor. Fruit ripens in early midseason. It is superior to Wallace and Willard in fruit flavor, appearance, and production, vine vigor, and disease resistance, and to Dearing in fruit flavor, size, and attractiveness.

*Roanoke* has attractive white fruit slightly tinged with golden yellow. It ripens in early midseason. It is superior to Wallace and Willard in fruit production, flavor, and attractiveness, and vine vigor—and to Dearing in yield and attractiveness.

*Magnolia* is a large, smooth-skinned white grape that ripens in midseason. It is superior to Wallace and Willard in fruit size, appearance, flavor, vigor, sugar content, and production, and to Dearing in these qualities except sugar content and vigor.☆

# AGRISEARCH NOTES

## New blackberry resists diseases

Williams, a new blackberry variety, produces outstanding yields in the South, because the plants resist cane and leaf diseases that weaken most established varieties there.

In tests, Williams yielded an average of 5.3 quarts per plant at Raleigh, N.C.; Brainerd, a good southern producer, yielded 3.1 quarts.

Williams plants do not have enough winter hardiness for growth north of Virginia and Tennessee, ARS scientists caution.

The new variety is a midseason blackberry—fruit ripens in late June. It is a little later than Boysen and a little earlier than Flint.

The glossy blackberries are medium in size, medium-firm, and of good dessert quality. They have an acid flavor. Fruit is suitable for local fresh markets and for home use.

The semierect plants can be propagated by root or cane cuttings. They are productive in hedge rows or if trained on trellises or stakes.

Williams plants will be available to growers in the South next fall. Cooperating nurserymen have limited stocks of plants for propagation.

The new variety was developed in cooperative research by USDA and the North Carolina and Mississippi Agricultural Experiment Stations. It originated in North Carolina from a cross of Himalaya and Taylor.

## Using Japanese quail in research

The newest kind of laboratory animal to be used in USDA animal husbandry research is the Japanese quail, believed the world's first domesticated bird.

This native of the Orient—where it's valued as food—is expected to be useful in studies by ARS poultry scientists. Small size, rapid generation turnover, and a close relationship to chickens are factors that should make this quail a valuable laboratory animal.

The Japanese quail (*Coturnix coturnix*) begins to lay eggs in about 42 days, compared to about 174 days for chickens. A mature quail weighs only 130 grams (4½ ounces) and is hardy. It lays about 250 eggs per

year. Egg size is 9.1 grams or 7 percent of body weight, more than double the egg weight-body weight ratio of hens.

Scientists are increasing an experimental population of the bird at the Agricultural Research Center, Beltsville, Md.



## $CO_2$ is good temporary anesthetic

Carbon dioxide given off by dry ice (solid $CO_2$) can be used to put laboratory animals to sleep for a short time. This gas worked better than chloroform or ether in experiments. It produced no excitement in guinea pigs and other animals.

Only 1 of more than 1,400 guinea pigs died from $CO_2$ liberated by the dry ice. The gas put them to sleep in 10 to 15 seconds. Anesthesia lasted about 45 seconds, and the animals recovered in about a minute.

A 2-pound cake of dry ice was broken into small pieces and placed in the bottom of an open metal container 18 inches long, 12 inches wide, and 14 inches deep. The animals were put on a removable wire platform 5 inches above the dry ice.

Guinea pigs anesthetized by the $CO_2$ were used in disease studies at USDA's Plum Island Animal Disease Laboratory, Greenport, Long Island, N.Y. In a few other tests there, $CO_2$ also worked well on chinchillas, rabbits, and mice.

This procedure was developed by ARS veterinarian J. L. Hyde. He says the dry ice produced no undesirable side effects in the animals.

The danger of explosion or fire—sometimes present when other materials are used to produce anesthesia—is eliminated by using dry ice. Hyde emphasizes that $CO_2$ and all other anesthetic gases should be used only in well-ventilated rooms.

## Return of yellow lupines possible

Yellow lupines were extensively used as a green manure, winter pasture, and seed crop in northern Florida and southern Georgia—before bean yellow mosaic virus (BYMV) made production unprofitable.

Now USDA scientists hope that yellow lupines can again be grown successfully in the Southeast. They have discovered a way to control the insects that are partly responsible for the spread of BYMV. The disease is also seedborne.

Research done in cooperation with the Georgia Agricultural Experiment Station shows that three systemic insecticides are effective against aphids that carry BYMV. The insecticides—dimethoate, phorate, and Di-Syston—are absorbed by treated lupines and kill aphids (chiefly green peach and cowpea aphids) that feed upon the plants.

ARS entomologists D. B. Leuck and

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E. W. Beck and pathologist H. D. Wells planted yellow lupines in isolated fields. The disease was carried by 7 percent of the seed. They applied insecticides when seedlings were 2 to 4 inches high and 5 or 6 weeks later. Rate of application was 2 pounds per acre of 10 percent dimethoate, phorate, or Di-Syston granules in 8-inch bands on the rows.

All three insecticides gave effective aphid control for 4 weeks. Experimental plots had the following percentages of BYMV-infected plants: dimethoate, 13; phorate, 23; Di-Syston, 33; untreated control, 81.

The researchers say further tests are needed before the insecticide treatments can be recommended. The chemicals are not registered by USDA for use on yellow lupines.

## New chrysanthemums are hardy

Four new chrysanthemums, hardy enough for growth in home gardens in most of the northern and northwestern States in the continental United States, have been developed by USDA.

The new varieties—Big Horn, Gold Choice, Shoshone, and Red Warrior—bring to 17 the number released during the past 3 years. These varieties resulted from intensive breeding studies conducted at the ARS Horticultural Field Station, Cheyenne, Wyo. All were developed by controlled hand pollination.

Big Horn is dense, well formed, upright, top blooming, and has clear orchid-pink blooms. Old flowers fade to silvery pink in hot weather. Flowers average 2½ inches in diameter and reach full bloom August 15–25 at Cheyenne.

Gold Choice is dense, upright, and of the best form. The color of the outer two-thirds of each bloom is golden pumpkin and the inner third

lemon yellow. The flowers are very high crowned and average 2¼ inches in diameter. They reach full bloom September 10–20 at Cheyenne.

Shoshone is a dense, well formed mound type and produces bright sulfur-yellow blooms that do not fade. Flowers average 3 inches in diameter and reach full bloom September 1–10 at Cheyenne.

Red Warrior is dense, well formed, upright, and top blooming. Its bloom color resembles garnet or wild strawberry red, the underside of each petal being a little paler. The flowers average 2¾ inches in diameter and reach full bloom September 1–10 at Cheyenne.

## Seed of flaxes being increased

Marine-62 and Windom, two new flax varieties developed in Federal-State research, have been announced by USDA and the Minnesota Agricultural Experiment Station.

Minnesota officials plan limited distribution of foundation seed to registered growers. The experiment stations in North Dakota and South Dakota are also taking part in the increase and distribution of seed.

In tests, Marine-62 produced 0.6 percent more oil than Marine, its parent variety. Marine-62 also does well if sown late. This can be an advantage in fields infested with wild oats, because the oats can be destroyed by cultivation before the flax is planted. The new variety is early maturing and has rust immunity and satisfactory wilt resistance. It is less susceptible to pasmo disease than any other flax except Arny.

Trials in the North-Central region showed the new variety has a slight average yield advantage over Marine. In oil-drying capacity, it is nearly the same as Marine.

Windom, a blue-flowered variety

with brown seeds like Marine-62, has a high yield potential whether sown early or late. Its oil quality is excellent, but the quantity is less than from other recommended varieties. It is immune to rust and resists wilt, but is moderately susceptible to pasmo disease. Windom is somewhat sensitive to the herbicide Dalapon. It should be applied at a rate *not* exceeding 12 ounces per acre.



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